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Tongue Analysis for Diabetes Using Convolutional Neural Network

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ABSTRACT: Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. The tongue is related to all the parts of our human body. The tongue can be used for the diagnosis of disease by using its various features such as colour, texture, geometry. Till date detection of diabetes is taking place only by the means of the invasive approach. But we have come with a non-invasive approach to detect diabetes. The difficulty faced by the doctors is the overlapping of colours, irregular shape and dominance of the saliva in the cracks of the tongue. So to detect the disease, we inspect the particular area of the tongue using image segmentation methods. The image enhancement method for processing the tongue image was proposed to find the diagnosis of the disease. In this method we have two methods, one is to find the edge detection, this can be achieved by size, shape and texture of the tongue another method is colour enhancement, which is used to identify different colours in thetongue. The outputs from these methods are given for the Convolutional NeutralNetwork for learning and classification.

KEYWORDS: Image segmentation, Image enhancement, Tongue analysis, Convolutional Neutral Network.

I. INTRODUCTION

The tongue is a muscular organ in the mouth of the most vertebrates that manipulate food for mastication and is used in the act of swallowing. It has importance in the digestive system and is the primary organ of taste in the gustatory system. The Chinese Traditional Medicine and the Indian Ayurveda Medicine uses tongue as the major part to analyse the condition of the human body. Both CTM and Ayurveda uses the colour and texture of the tongue as the major features to analyse the physical conditions of the body. This proposed work is mainly focused on the diabetes. In fast growing years, people's food habits are much differed and thus the indigestion is prominent among most of us. This is the main reason for the cause of diabetes. This project mainly focuses on a non-invasive approach to detect diabetes using the colour and the texture of the tongue through image segmentation techniques. The section gives various image processing technique such as Image Enhancement, Image Restoration, Image Analysis, Image Compression and Image Synthesis. MATLAB supports the entire data analysis process, from acquiring data from external device and database, through pre-processing, visualization and numerical analysis, to producing presentation-quality output.

The rest of this paper is organized as follows. Section II describes the literature survey, it gives an idea of segmentation the tongue image based on the geometric and colour feature. To classify the image to use Convolutional Neutral Network technique that is given in Section III. Experimental results are reported in section IV. Finally, Section V presents conclusion.

II. RELATED WORK

A method to detect Diabetes Mellitus using a support vector machine classifier. The Bi- Elliptical Deformable Contour is used to segment the tongue image. The colour, texture and geometry features are extracted from the tongue foreground image and classified using support vector machine. Applying the image processing based on the feature extraction technique. These features will be classified by using SOM Kohonen classifier. Uses digital image processing and pattern recognition technologies. Image processing is transferred from RBG colour space to HSV colour space and International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET)



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the average H and S values are consider as the colour features. A novel region-based hierarchical filtering frame work is proposed to robustly detect tongue features.

This paper proposes fuzzy c means technique to extract the region as it encourages convergence in boundary concavities and also provides better results in the detecting diabetes mellitus. Moreover the hybrid classifier using deep convolutional neutral network have been proposed and developed in this research work and gives promising results.

III. METHODOLOGY

To classify the image we use Convolutional Neural Network technique. A convolutional neural network consists of an input layer, hidden layers and an output layer. In any feed-forward neural network, any middle layers are called hidden because their inputs and outputs are masked by the activation function and final convolution. In a convolutional neural network, the hidden layers include layers that perform convolutions. Typically this includes a layer that does multiplication or other dot product, and its activation function is commonly ReLU. This is followed by other layers such as pooling layers, fully connected layers, and normalization layers. Once a network has been structured for a particular application, that network is ready to be trained. To start this process the initial weights are chosen randomly. Then, the training, or learning, begins. There are two approaches to training - supervised and unsupervised. Supervised training involves a mechanism of providing the network with the desired output either by manually "grading" the network's performance or by providing the desired outputs with the inputs. Unsupervised training is where the network has to make sense of the inputs without outside help. The vast bulk of networks utilize supervised training. Unsupervised training is used to perform some initial characterization on inputs. When you train networks for deep learning, it is often useful to monitor the training progress.

IV. EXPERIMENTAL RESULTS

Figures shown below are the given input images



Figure 1Healthy tongue

Figure 2 Diabetic tongue

The elapsed time for the training process is about 5 minutes 16 seconds. We carried out 15 epochs and 15 iteration. For every epoch single iteration will take place. Every time the iteration takes place, the training progress can be noted clearly. Also the accuracy and losses per iteration are displayed in the Accuracy – Iteration and Loss – Iteration graph. The first iteration started at 00:00:23 hrs with an accuracy of 61.76%. As the training progresses the mini batch loss of 0.1153 are evident in the figure 3 and figure 4.



Figure 3 Training Progress of Healthy Patient

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	Epoch	1	Iteration	1	Time Elapsed	1	Mini-batch	1	Mini-batch	I.	Base Learning
L					(hh:mm:ss)	1	Accuracy	1	Loss	L	Rate
=								-		-	
	1	1	1	1	00:00:23	1	61.76%	1	4.3351	1	1.0000e-04
	15		15	1	00:06:47	1	97.06%	1	0.1153	1	1.0000e-04

Figure 4 Parameter output of healthy tongue

The accuracy and losses per iteration are displayed in the Accuracy – Iteration and Loss – Iteration graph. The first iteration started at 00:01:20 hrs with an accuracy of 38.24%. As the training progresses the mini batch accuracy has resulted in 98.53% with a mini batch loss of 0.1550 are evident in the figure 5 and figure 6.



Figure 5 Training Progress of Diabetic Patient

itializi	ing	input data	no	rmalization.						
Epoch	1	Iteration	1	Time Elapsed (hh:mm:ss)	1	Mini-batch Accuracy	1	Mini-batch Loss	1	Base Learning Rate
1	1	1	I	00:01:20	1	38.24%	ī	6.0475	1	1.0000e-04
15	1	15	1	00:07:19	1	98.53%	1	0,1550	1	1,0000e-04

Figure 6 Parameter output of diabetic tongue

V. CONCLUSION

This project proposed a solution to diagnose diabetes through tongue analysis. Apart from Hybrid classifier, Minimum distance classifier, Support vector machine involved in GVF segmentation technique, the deep learning technique using Convolutional Neural Network provides a way to enhance the results with greater accuracy and lesser time complexity. The average accuracy obtained by our system is 95.4% and the average elapsed time is around 5 minutes. Thus if we use this system in hospitals hygiene will be maintained for sure and there will be more accuracy towards identifying the diseases. This project can be implemented in the mobile application as well to facilitate common people to inspect their body conditions if they face any discomfort.

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